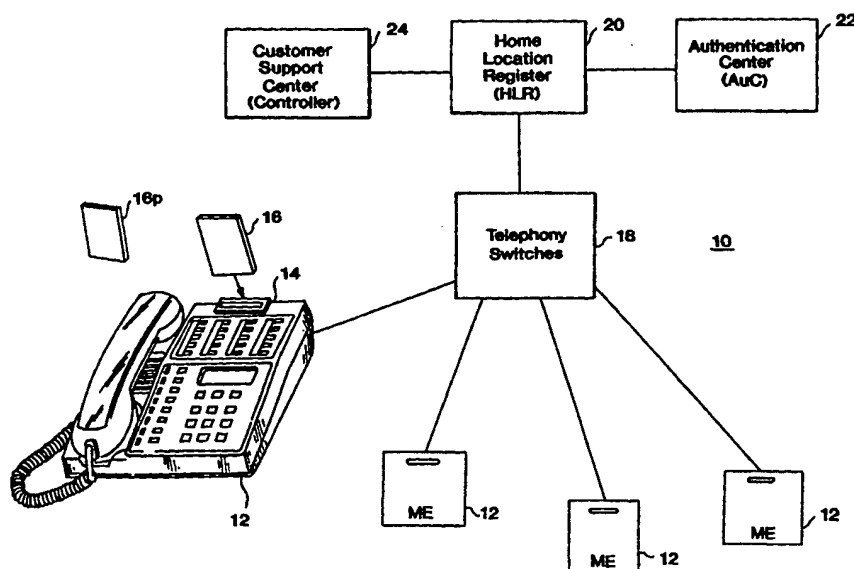




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## (54) Title: COMMUNICATION NETWORK HAVING REPLACEABLE SIM CARD



## (57) Abstract

A personal servicing communication network (10) is configured to allow a subscriber to use a replacement SIM card (16) by merely inserting the replacement card (16) into one of a plurality of network communication terminals (12), with the network automatically disabling the old SIM card (16p) and enabling the replacement SIM card for subsequent use. A Home Location Register (HLR) (20) and an Authentication Center (AuC) (22) are preprovisioned by an administrator to correlate an identifier of the replacement SIM card with an identifier of the original SIM card for allowing the subscriber to access the network. Upon first use of the replacement SIM card, the network disables the original identifier in the Home Location Register (HLR) (20) and in the Authentication Center (AuC) (22) so that subsequent access to the network by the subscriber is available solely by use of the replacement SIM card.

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COMMUNICATION NETWORK HAVING REPLACEABLE SIM CARDBACKGROUND OF THE INVENTION

The present invention relates generally to personal servicing communication systems or networks, and, more specifically, to authorized access thereto using a Subscriber Identity Module (SIM) card.

A personal servicing communication network provides individual person oriented services instead of terminal device oriented services. In the latter, a typical phone system allows use by any caller as allowed by the specific service subscribed to with billing being provided for a specific telephone irrespective of who places the call. In the former, a personal servicing communication network allows individual callers to access subscribed services using a Subscriber Identity Module (SIM) card for accessing any available terminal device or telephone configured to accept the card. Billing is not provided for each of the terminals, but is instead provided to a given individual having the SIM card. In this way, a subscriber may have a wide range of mobility and use any available terminal by simply inserting the SIM card therein for accessing the communication network to communicate with other terminals.

The terminals of the communication network may be hard wired into the network like conventional telephone networks, or may use radiowaves for accessing the network like typical cellular phones. The required components of a personal servicing communication network are effected in accordance with a suitable

standard such as that conventionally known as the European Digital Cellular Telecommunications System, Global System for Mobile Communications (GSM), Phase 1, by the European Telecommuinications Standards Institute, Technical  
5 Specifications. The GSM standard is also known as the European Cellular Phone standard for such networks found in Europe. In the United States, a comparable GSM-like standard includes multiple components such as the Interim Standard 41 and the Advanced Mobile Phone System (AMPS).

10 In a typical GSM standard communication network, a plurality of communication terminals such as mobile equipment (ME) are geographically spaced apart from each other and are operatively joined to one or more telephony switches for completing calls between the various terminals. Each terminal includes a slot for  
15 receiving the SIM card which allows access to the communication network in accordance with a subscriber service profile maintained for each subscriber which authorizes the desired services contracted for including for example voice, data, fax, voice mail, short message, and supplementary services for  
20 example. The subscriber profile is maintained in a Home Location Register (HLR) which is operatively joined to the telephony switch. An Authentication Center (AuC) is operatively joined to the HLR register for securing access to the communication network only to authorize subscribers. A customer support center  
25 includes suitable equipment and controllers operatively joined to the HLR register for allowing administrators of the communication network to enter or delete subscribers from the

network or change the contracted services as desired for controlling the operation of the network.

The SIM card is an electronic device having a conventional central processing unit (CPU) and memory therein which is plugged or inserted into the terminal for accessing the network. Over the course of time, the SIM card wears out either at its contact terminals or internally due to the repeated rewriting of data to the memory therein during operation. Or, the SIM card may be lost or stolen. In any event, a replacement SIM card must be issued to the specific subscriber to replace the previous or old SIM card and allow access to the network. The replacement process typically requires direct administrator support which requires the subscriber to first insert the SIM card into a terminal and contact the customer support center. This is a manual process that requires certain actions by both the administrator and the subscriber and delays the subscriber's ability to immediately use the replacement SIM card.

#### Summary of the Invention

A personal servicing communication network is configured to allow a subscriber to use a replacement SIM card by merely inserting the replacement card into one of a plurality of network communication terminals, with the network automatically disabling the old SIM card and enabling the replacement SIM card for subsequent use. The Home Location Register (HLR) and the Authentication Center (AuC) are preprovisioned by an administrator to correlate an identifier of the replacement SIM

card with an identifier of the original SIM card for allowing the subscriber to access the network. Upon first use of the replacement SIM card, the network disables the original identifier in the Home Location Register (HLR) and in the Authentication Center (AuC) so that subsequent access to the network by the subscriber is available solely by use of the replacement SIM card.

#### Brief Description of the Drawings

The invention, in accordance with preferred and exemplary embodiments, together with further objects and advantages thereof, is more particularly described in the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a schematic representation of a portion of a personal servicing communication network in accordance with one embodiment of the present invention.

Figure 2 is a flow chart representation for allowing automatic disabling of an old SIM card upon first use of a replacement SIM card in the communication network illustrated in Figure 1.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Illustrated schematically in Figure 1 is the relevant portion of a personal servicing communication system or network configured in accordance with the present invention. The

network 10 includes a plurality of geographically spaced apart communication terminals 12 such as a conventional mobile telephone or equipment (ME) for use by subscribers to place and receive communications such as voice, data, voice mail, short message and supplementary services which are conventionally known and contracted for by the individual subscribers. Each terminal 12 includes a suitable handset and dialing keypad, for example, as well as a conventional electronic interface 14 for accessing, by reading from and writing to, a Subscriber Identity Module (SIM) card 16 insertable into a slot therein. The SIM card 16 is conventional and includes for example its own central processing unit (CPU) and memory, in which memory is suitably stored relevant information including a SIM serial number, an identifier conventionally known as an International Mobile Subscriber Identity (IMSI) which identifies the specific subscriber, with the memory typically also including information about the subscriber's service profile contracted for which controls the subscriber's access to the network 10 and for which a subscriber is billed. The IMSI identifier is unique to each SIM card 16 and is used to identify a given subscriber for that card 16.

The network 10 further includes a plurality of geographically spaced apart telephony switches 18 located remotely from the terminals 12 and operatively joinable thereto by either direct, ground based communication lines, or by mobile transmission through the air using radiowaves. Each switch 18 is a conventional component having a programmable CPU, suitable software, databases, trunk lines etc. A respective switch 18 is

used for establishing a communication link from an access one of the terminals 12 in which the card 16 is inserted to another device such as one of the other terminals 12 through the same or different switch 18.

5           The network 10 further includes a Home Location Register (HLR) 20 which is operatively joined to the switches 18 and is configured to contain or store for each subscriber a subscriber service profile associated with a corresponding SIM card ISMI identifier for specifying authorized services available to the  
10           subscriber in the network 10. The register 20 also includes a last location address identifying which of the several switches 18 was serving the access terminal 12 used to access the network 10 using the SIM card 16 so that calls may be directed thereto as long as the SIM card 16 remains in the terminal 12. An  
15           Authentication Center (AuC) 22 is operatively joined to the register 20 for securing access to the communication network 10 based on an authentication key stored in the Authentication Center 22 and in the SIM card 16, and associated with the SIM card IMSI identifier as is conventionally known.

20           The network 10 also includes a customer care or support center 24 which includes suitable equipment and a controller operatively joined to the register 20 and administered by one or more administrators. From the support center 24, the administrators control operation of the network 10.

25           The overall communication network 10 illustrated in Figure 1 including its individual components is conventionally configured and operated in accordance with a suitable standard such as a GSM standard introduced above. But for the present



invention, a subscriber requiring a replacement SIM card would have to first insert the replacement SIM card 16 into one of the terminals 12 to directly contact the support center 24 and cooperate with an administrator to enable full use of the replacement card 16 and disable the previous or old card 16p. In accordance with the present invention, the network 10 is modified or reconfigured to allow the subscriber to simply insert the replacement card 16 into any one of the terminals 12 and upon first use of the card 16 the network 10 automatically enables full use of the replacement card 16 in accordance with the subscriber's existing service profile while disabling the previous or old SIM card 16p without direct action by one of the administrators during the first use of the card.

More specifically, and referring to Figure 2, the basic process for replacing the old or previous SIM card 16p is illustrated in flowchart form. In the event that a subscriber requests the issuance of a replacement SIM card, or the support center 24 proactively issues a replacement SIM card after a predetermined time period, replacement of the old SIM card 16p is thereby initiated with a replacement card 16 being initially processed by the support center 24 for use by the same subscriber of the old SIM card. The support center 24 suitably provisions the network 10 for the replacement SIM card 16 by provisioning both the register 20 and authorization center 22 (refer also to Figure 1) with a correlation between the previous IMSI identifier associated with the previous SIM card and a replacement or different IMSI identifier for the replacement SIM card. This is accomplished by suitable software so that a given subscriber

requiring the replacement card may initially access the network 10 with either of the old or replacement SIM cards according to the existing profile contained in the register 20 for the given subscriber.

5           The replacement SIM card is provided or suitably delivered to the subscriber who may then insert the replacement SIM card into one of the terminals 12 to access the network 10 according to the respective subscriber profile previously established by the subscriber. Upon inserting the SIM card 16 into the terminal  
10   12, the terminal 12, conventionally known as a Mobile Equipment (ME), then becomes a conventionally known Mobile Station (MS) operatively joined to one of the telephony switches 18. Upon first use of the replacement SIM card 16 by the subscriber the MS effected at one of the terminals 12 initiates location update  
15   in the register 20 for identifying the switch 18 accessed by the terminal 12, with the register 20 requesting authentication and information from the Authentication Center 22 using the replacement IMSI identifier. The Authorization Center 22 is also configured to similarly correlate the previous IMSI identifier  
20   with the replacement ISMI identifier. The old and replacement IMSI identifiers allow access to the Authentication Center 22 and correspond with respective authentication keys stored therein. Upon such first use of the replacement SIM card 16, the previous or old IMSI identifier contained in both the register 20 and the  
25   Authentication Center 22 are disabled to prevent further access to the network 10 by the previous or old SIM card 16p. Up until this time either the previous SIM card 16p or the replacement SIM card 16 may be used to access the network 10.

The location update initiated by the MS terminal 12 effects a request for authentication information such as the authentication key from the Authentication Center 22 by the register 20 since this will be the first time that the network 10 has seen the replacement IMSI identifier. This will result in the authentication center 22 disabling the old IMSI identifier in the Authentication Center 22. The location update request to the register 20 will similarly result in the old IMSI identifier being disabled in the register 20. The subscriber profile for the replacement IMSI identifier will be the same profile used for the old IMSI identifier, with the replacement IMSI identifier simply superseding or replacing the old IMSI identifier. Accordingly, the replacement IMSI identifier is retained in the register 20 and the Authentication Center 22 for allowing subsequent access to the network 10 for the subscriber's existing profile upon use of the replacement SIM card 16 having the replacement IMSI identifier stored therein. In this way, the network 10 clears the old IMSI identifier from the network 10 so that it is no longer usable.

Accordingly, upon disabling or clearing the old IMSI identifier from the register 20 and the Authentication Center 22, they are thereby reconfigured to allow subsequent access to the network 10 solely by the replacement SIM card 16 for the given subscriber according the same or original subscriber profile for that subscriber. After the first use of the replacement SIM card 16, the previous SIM card 16p will no longer be recognized by the network 10.

In the event the previous SIM card 16p were stolen, the subscriber would notify the support center 24 which in turn would conventionally disable its use either by disabling the IMSI identifier in the register 20 and the Authentication Center 22 or by suitably modifying the subscriber's profile to limit access to the system solely for contacting the support center 24 without being able to enjoy available services within the network 10. The replacement SIM card 16 issued after the theft or loss of the previous SIM card may also be automatically enabled in accordance with the present invention by providing the required correlation between the replacement IMSI identifier and the previous IMSI identifier.

The present invention's ability to allow automatic use of the replacement SIM card 16 for replacement of the previous SIM card 16p is suitably configured in the conventional components of the network 10 using conventional software, and in accordance with the GSM standards. Except for introducing the invention into the network 10, the network 10 is otherwise conventional in structure and operation for complying with the GSM standard.

For example, prepersonalization of the replacement SIM card 16 prior to provisioning the register 20 and the Authentication Center 22 to correlate the replacement and previous IMSI identifiers may be accomplished to allow at least the subscriber's access to the network 10 upon merely issuing the replacement SIM card 16 to the subscriber. Prepersonalization may be accomplished in any of a number of conventional ways consistent with the GSM standard. For example, all necessary information may be preloaded into the replacement SIM card. The

replacement SIM card may be preloaded at the point of sale retail outlet wherein the subscriber may purchase an ME terminal 12 and/or pick up the replacement card. Or, conventional telephone administration (TeleAdmin) may be used for loading the required subscriber's specific information via the network 10 itself using the conventionally known short message infrastructure. The information is received into the replacement SIM card and loaded into the memory thereof. This is the preferred option since it provides the greatest level of flexibility.

After the first use of the replacement SIM card 16 which enables the replacement IMSI identifier and disables the previous IMSI identifier, the replacement SIM card 16 may then undergo personalization or post-personalization to download into the memory thereof at least part of the subscriber's profile, or suitable information about the profile. The subscriber may access the network 10 by either a landline telephone terminal 12 or a mobile equipment (ME) terminal 12 through which the subscriber may contact the support center 24. The support center 24 may then personalize the replacement SIM card 16 as desired using the TeleAdmin capability of the short message service. In this way all necessary information is downloaded into the replacement SIM card 16 via the network 10 so that the subscriber is able to fully use all provisioned services contracted for.

The present invention therefore allows more convenient use by the subscriber of the replacement SIM card 16 without requiring direct contact or action with the support center 24 for its use. Simply inserting the replacement SIM card 16 in any of the terminals 12 of the network 10 automatically supersedes the

old IMSI identifier and thereby disables the old SIM card 16p, with the replacement SIM card 16 thereafter being usable for all provisioned services contained in the subscriber service profile contained in the HLR register 20.

5           While there have been described herein what are considered to be preferred and exemplary embodiments of the present invention, other modifications of the invention shall be apparent to those skilled in the art from the teachings herein, and it is, therefore, desired to be secured in the appended claims all such  
10 modifications as fall within the true spirit and scope of the invention.

Accordingly, what is desired to be secured by Letters Patent of the United States is the invention as defined and differentiated in the following claims:

Claims

1. A personal servicing communication network comprising:

a plurality of communication terminals for use by a subscriber and including an interface for accessing a Subscriber Identity Module (SIM) card insertable therein, said SIM card  
5 including an identifier and an authentication key;

a plurality of telephony switches operatively joinable to said terminals for establishing a communication link from an access one of said terminals in which said card is inserted;

a Home Location Register operatively joined to said switches  
10 and configured to contain for each subscriber a subscriber profile associated with said SIM card identifier for specifying authorized services in said network and a last location address identifying which of said switches was last serving said access terminal using said SIM card;

15 an Authentication Center operatively joined to said register for securing access to said communication network based on said authentication key stored in said Authentication Center and in said SIM card and associated with said SIM card identifier; and

20 wherein said register is configured to correlate a previous identifier for a previous SIM card with a replacement identifier for a replacement SIM card for a given subscriber so that said given subscriber may initially access said network with either of said previous or replacement SIM cards.

2. A network according to claim 1 wherein said register is further configured to automatically disable said previous

identifier to prevent access to said network by said previous SIM card upon first use of said replacement SIM card and  
5 corresponding replacement identifier.

3. A network according to claim 2 wherein said authentication center is also configured to correlate said previous identifier with said replacement identifier and corresponding identification authentication keys associated therewith so that upon said first  
5 use of said replacement SIM card a request for authentication information by said register to said authentication center will cause said authentication center to automatically disable said previous identifier therein.

4. A network according to claim 3 wherein said register in said Authentication Center are further configured to allow subsequent access to said network according to said subscriber profile for said given subscriber after said first use of said replacement  
5 SIM card solely by said replacement SIM card for said given subscriber and not by said previous SIM card for said given subscriber.

5. A network according to claim 4 wherein said terminals are mobile equipment operatively joinable to said switches by radiowaves.

6. A method of allowing automatic access to a personal servicing communication network by an existing subscriber issued a replacement Subscriber Identity Module (SIM) card for a



previous SIM card, said network including a plurality of  
5 communication terminals operatively joinable to a plurality of  
telephony switches and in turn operatively joined to a Home  
Location Register containing subscriber service profiles, and in  
turn operatively joined to both an Authentication Center  
containing authentication keys for subscriber SIM cards and to  
10 a customer support center for administering said network, said  
method comprising:

provisioning by said support center, said register and said  
Authentication Center with a correlation between a previous  
identifier associated with said previous SIM card and a  
15 replacement identifier for said replacement SIM card;

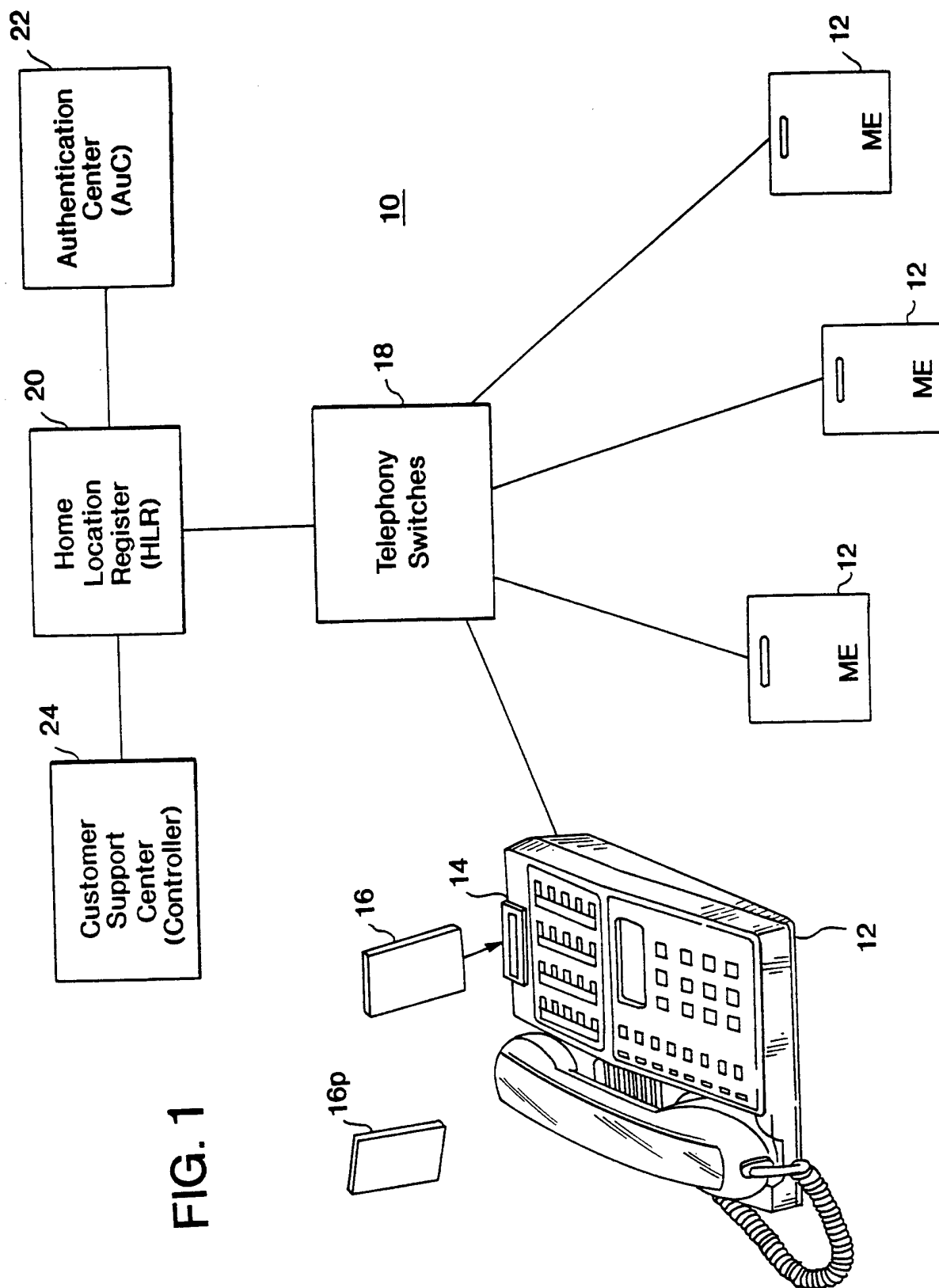
inserting said replacement SIM card into one of said  
terminals to access said network according to a respective one  
of said subscriber profiles;

initiating a location update by said terminal to said  
20 register;

requesting an authentication key from said authentication  
center by said register to authorize access by said replacement  
SIM card to said network; and

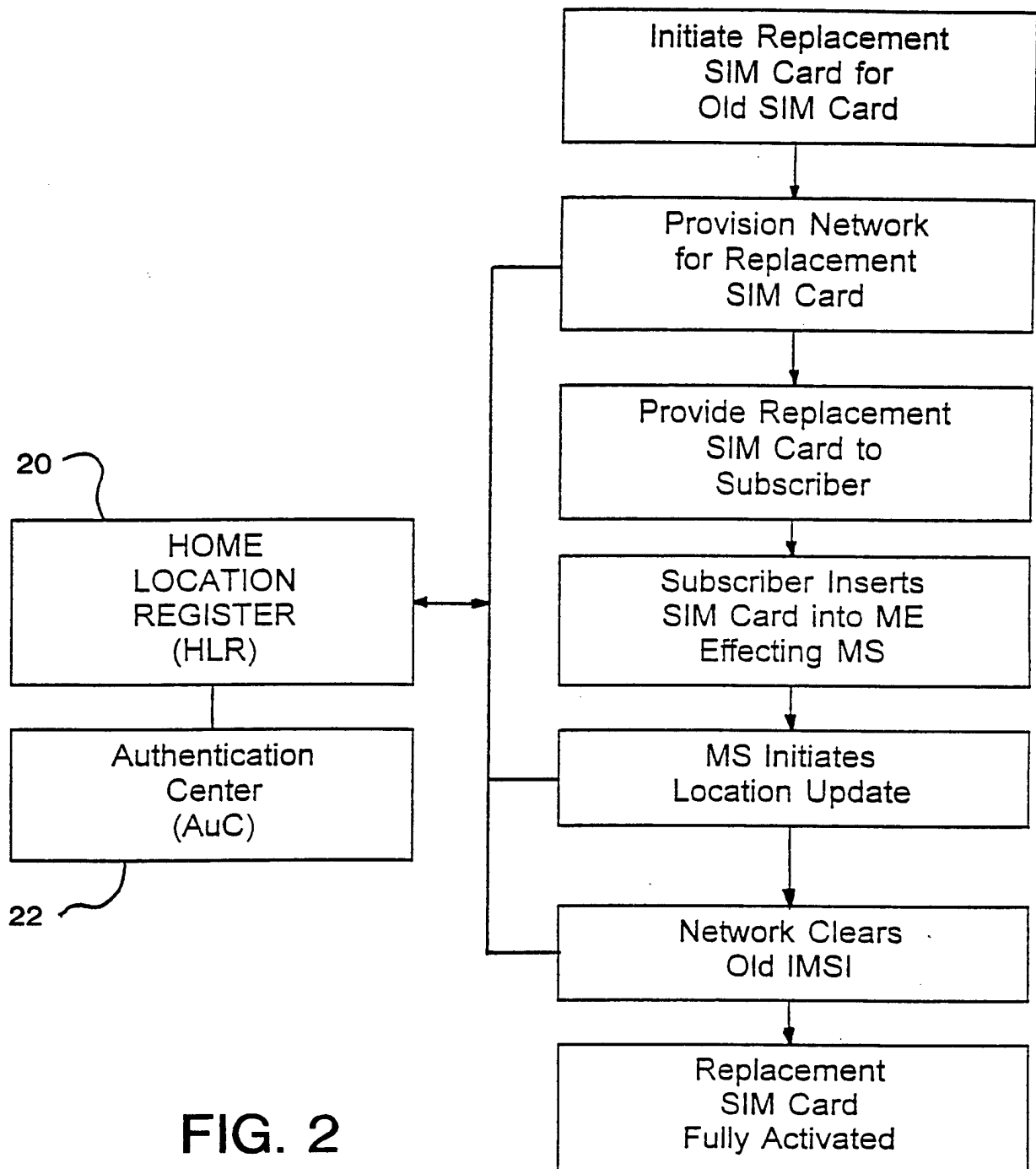
disabling said previous identifier in said register and in  
25 said Authentication Center upon authentication from said  
Authentication Center upon first use of said replacement SIM card  
while retaining said replacement identifier for subsequent access  
to said network by said replacement SIM card having said  
replacement identifier.

7. A method according to claim 6 further comprising:  
prepersonalizing said replacement SIM card prior to said provisioning step to allow subscriber access to said network.
8. A method according to claim 7 further comprising post-personalizing said replacement SIM card after said disabling step to download thereto information about said subscriber profile.



**FIG. 1**

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US96/10742

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : H04Q 7/20, 7/24

US CL : 379/58, 59, 355, 357; 455/89, 90

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/58, 59, 355, 357; 455/89, 90

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP, A, 0,481,714 (SOMMERVILLE) 22 APRIL 1992, ABSTRACT; COL. 1, LINES 13-28; COL. 3, LINE 15 TO COL. 5, LINE 46; COL. 5, LINES 53 TO COL. 6, LINE 9.	1-8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed	

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